

WHAT IS CLAIMED IS:

1. A method for searching at least one character image embedded in an image, comprising:
 - providing the image;
 - detecting a character region in the image based upon line widths of the character image contained in the character region;
 - extracting a first visual feature of the character region;
 - providing a character image of interest;
 - extracting a second visual feature from the character image of interest;
 - comparing the first visual feature with the second visual feature to determine a level of similarity; and
 - outputting the character region with the level of similarity.
2. The method for searching character image in an image, as claimed in Claim 1, wherein at the step of outputting said character region outputs character regions in the descending order of the level of similarity.
3. The method for searching character image in an image, as claimed in Claim 1, wherein the step of detecting said character region on the basis of its shape determines, as a character, a region where equi-luminance pixel strings are locally concentrated, in the equi-luminance pixel strings, pixels having luminance differences in a pre-designated range are consecutive as long as a pre-designated extent.

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4. The method for searching character image in an image, as claimed in Claim 1, wherein the step of detecting said character region on the basis of its shape determines, as a character, a region where equi-luminance pixel strings extending over a pre-designated length with a luminance difference within a pre-designated range in both vertical and horizontal directions are present at the same time within the same image range.

5. The method for searching character image in an image, as claimed in Claim 1, wherein

at the step of extracting the first visual feature of said character area and at the step of extracting the second visual feature of said character area, both the first visual feature and the second visual feature to be extracted are one-dimensional feature strings in which the numbers of edges in the vertical direction obtained by binarization of character regions and character strings are arrayed horizontally, and

the step of determining a level of similarity determines the level of similarity by elastic matching of one-dimensional feature strings both of which constitute the first visual feature and the second visual feature.

6. The method for searching character image in an image, as claimed in Claim 1, wherein

at the step of extracting the first visual feature of said character area and at the step of extracting the second visual feature from said character image, both the first visual feature and the second visual feature to be extracted are one-dimensional feature strings where the numbers of edges in the horizontal direction obtained by binarization of character regions and character strings are arrayed vertically, and

the step of determining a level of similarity determines the level of similarity by elastic matching of one-dimensional feature strings both of which constitute the first visual feature and the second visual feature.

7. An apparatus for searching character image in an image comprising:

a means for entering an image, a means for detecting a character region from the frame of the entered image on the basis of its shape,

a means for extracting a first visual feature of the character area,

an input means for entering any desired character codes,

a character image generating means for drawing as an image characters matching the character codes,

a means extracting a second visual feature from the character image,

a feature matching means for matching the visual features and visual features earlier extracted from an input frame image and determining a level of similarity, and

an output means for outputting as the result of search the character region matching the visual features in respect of which the level of similarity has been determined or a frame of image containing the region.

8. The apparatus for searching character image in an image, as claimed in Claim 7, wherein said output means outputs character regions in the descending order of the level of similarity obtained by the feature matching means.

9. The apparatus for searching character image in an image, as claimed in Claim 7, wherein said character region detecting means has as its determining

conditions the locally concentrated presence of equi-luminance pixel strings extending over a pre-designated length with a luminance difference within a pre-designated range.

10. The apparatus for searching character image in an image, as claimed in Claim 7, wherein

said means for extracting the first visual feature of said character area and the means for extracting the second visual feature from said character image, both the first visual feature and the second visual feature to be extracted are one-dimensional feature strings where the numbers of edges in the vertical direction obtained by binarization of character regions and character strings are arrayed horizontally, and

said feature matching means performs feature matching by elastic matching of one-dimensional feature strings both of which constitute the first visual feature and the second visual feature.

11. A program for processing of character search in an image, for causing a computer

to execute procedures,

to detect a character region from the frame of an entered image on the basis of its shape,

to extract a first visual feature of the character area,

to draw as an image a character string to be searched for which has been entered by a character input means,

to extract a second visual feature from the drawn character area image,

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to match the first visual feature and the second visual feature to determine a level of similarity, and

to output the character region containing a character string in respect of which the level of similarity has been determined.

12. The method as claimed in claim 1, whereby the step of detecting said character region includes extracting lines with a width in a specific range and extracting a concentrated region of the extracted lines as said character region.

13. The method as claimed in claim 12, whereby the line width is decided by a number of pixels with a luminance within a specific range or of equi-luminance.

14. The method as claimed in claim 12, whereby the line width is taken in vertical and horizontal directions.

15. The method as claimed in claim 14, whereby the concentrated region is decided by multiplying a pixel number in the x direction with a pixel number in the y direction.

16. The method as claimed in claim 1, whereby at least one of the visual feature extracting steps includes extracting a character image feature string along one dimension of the character region or the character image of interest by counting edges with a predetermined luminance change.

17. The method as claimed in claim 1, further comprising a step of removing line border blurring by correcting a border pixel luminance value into a maximum or minimum luminance value of adjacent pixels.

18. The method as claimed in claim 1, further comprising a step of removing non-character background in the image by outlining the character region with a rectangle having a sufficient margin, then removing pixels outside of the rectangle and with the same colors and luminance values as the background.

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